Air Quality Modeling for the PM_{10} SIP (State Implementation Plan)

A simplified description of a complex process

Utah Division of Air Quality
June 28, 2001

Basic Inventory Concepts

Five "criteria" pollutants inventoried by the Division of Air Quality

- CO (carbon monoxide)
- O_3 (ozone)
- NO_x (nitrous oxides)
- SO_x (sulfur oxides)
- PM_{10} (fine particulates)

Three of these are major contributors to PM_{10}

- NO_x
- SO_x
- PM_{10}

Basic Inventory Concepts (cont)

How the pollutants "act" in the air

- PM_{10} → directly emitted to the air
- SO_x → atmospheric reactions → SO_4 (sulfate particles)
- NO_x → atmospheric reactions → NO_3 (nitrate particles)

The emissions inventory has three categories

- **Area -** Diffuse sources; home heating, small commercial establishments, off road mobile, etc.
- **Point -** Large industrial sources emitting more than 25 tons/year of SO_x, NO_x, or PM_{10}
- **Mobile -** Auto and truck traffic on local, arterial and interstate roadways

The UAM-AERO Model

Urban **A**irshed **M**odel with **AERO**sol chemistry

3 Components to the Model

- Meteorology
- Emissions Inputs
- Atmospheric Chemical Reactions

• A "base case" for a typical episode of elevated PM_{10} establishes the model's performance (1996)

• The model will now be used to project future levels of PM_{10} to estimate possible exceedences of the health standard

• Only the emissions inputs change, based on growth projections, for future years

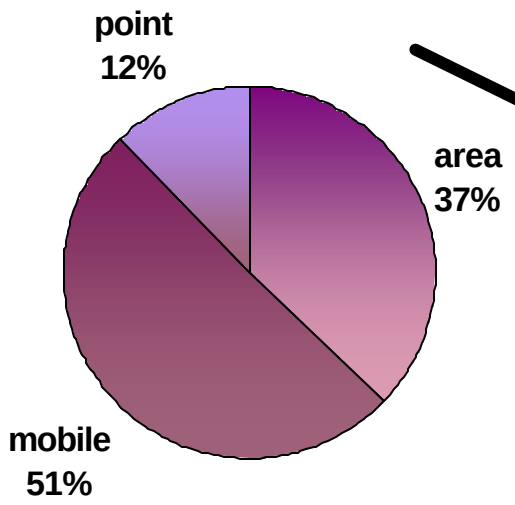
• Meteorology and atmospheric reactions remain fixed to 1996 conditions assuming these conditions will reoccur in the future

The art and science of air quality modeling helps to:

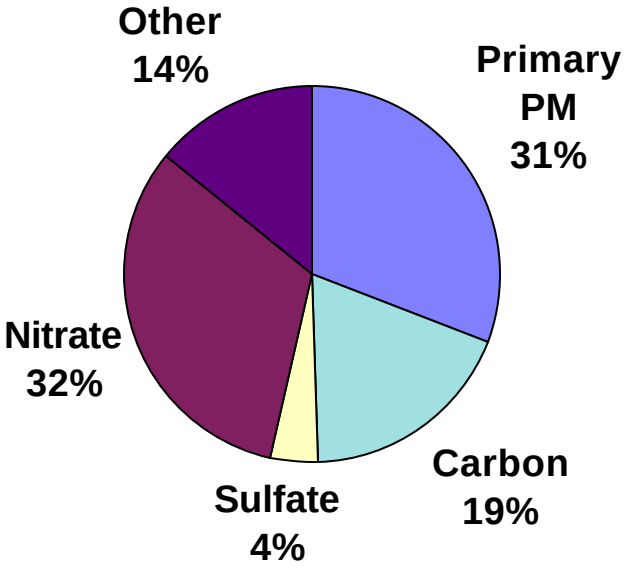
- **Identify relationships** between segments of the inventory and sub-components of total PM_{10} (nitrate, sulfate, carbon, dust, etc.)

- Develop **equitable control strategies** for the stakeholders affected by the three inventory sectors (area, point, and mobile)

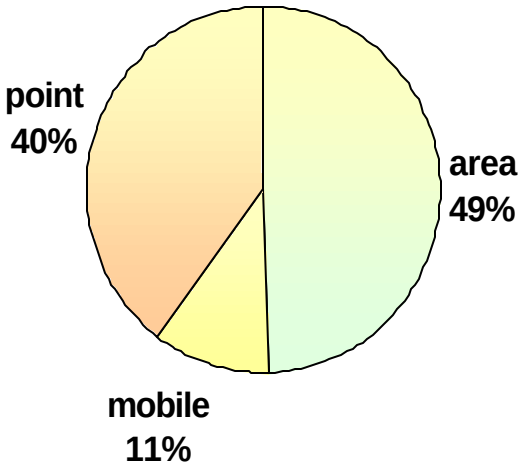
Salt Lake County NOx



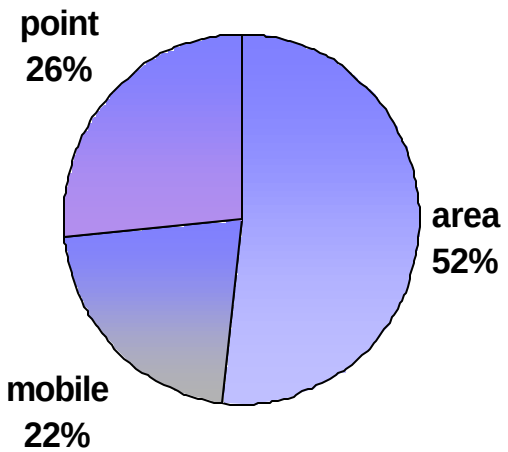
Monitored Concentrations During 1996 Episode (Salt Lake County)



Salt Lake County SOx



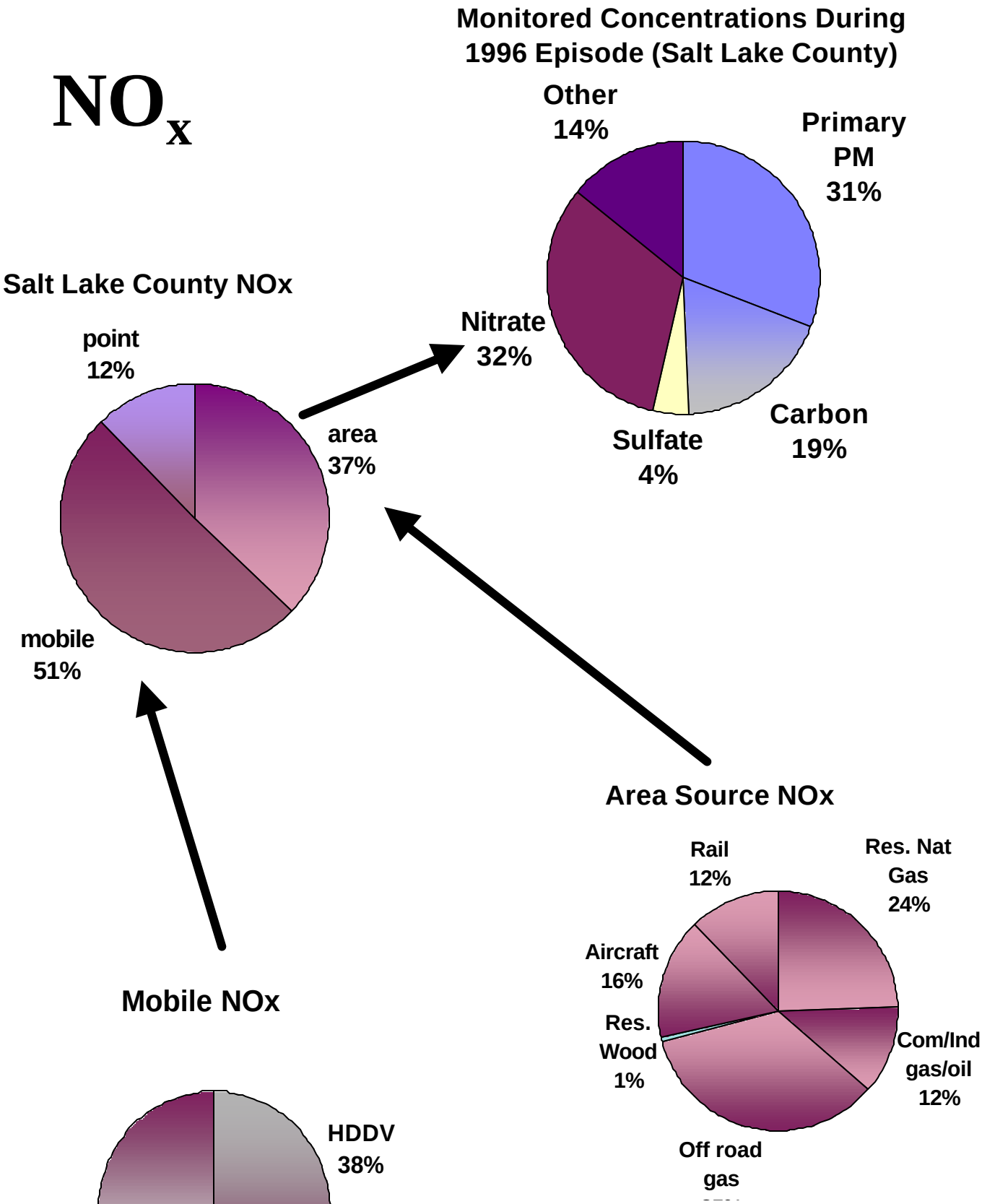
Salt Lake County PM10



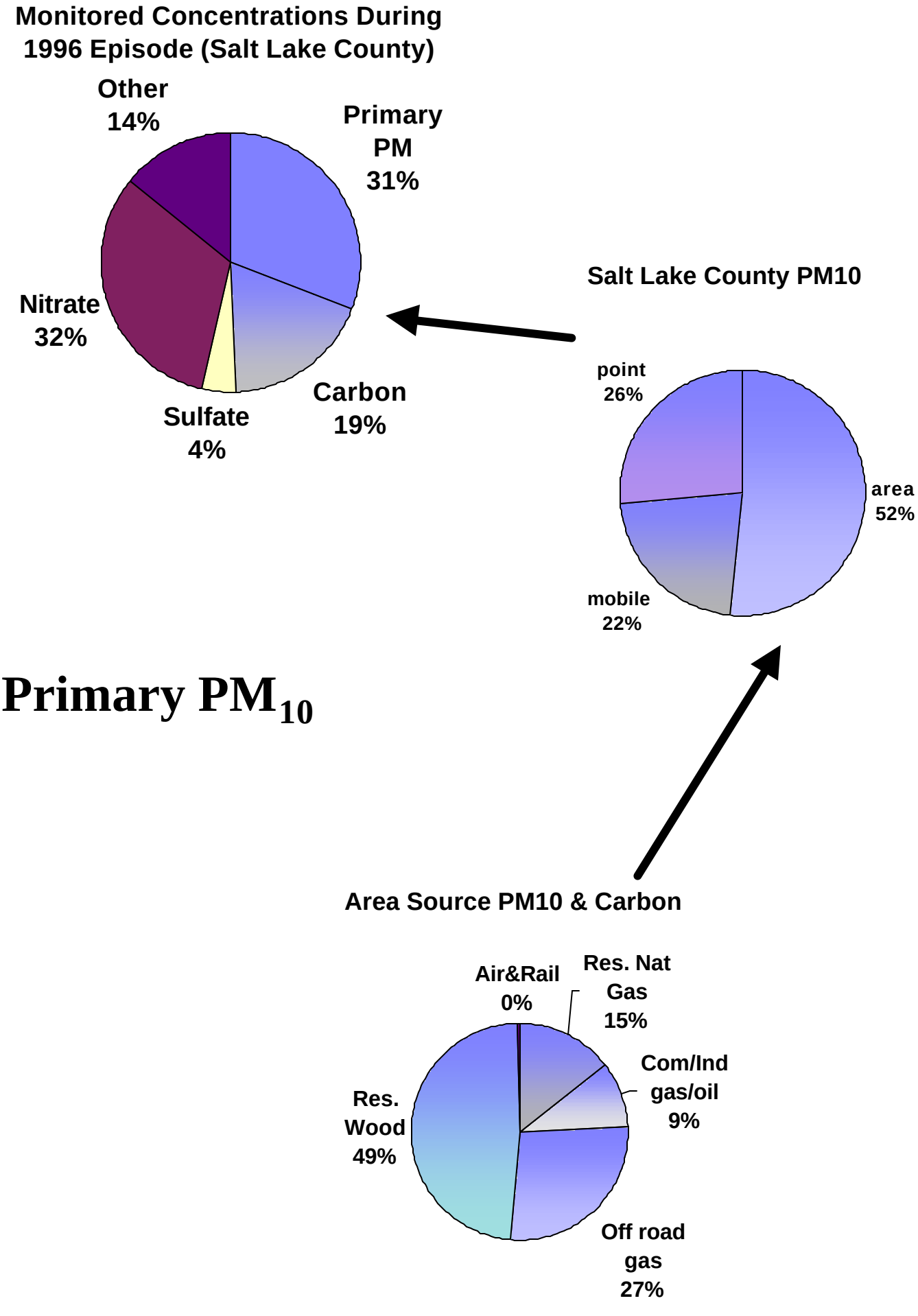
Observations = *u*g/m^3

Inventory = tons/year

NO_x


Monitored Concentrations During 1996 Episode (Salt Lake County)
Other 14%
Primary PM 31%
Nitrate 32%
Carbon 19%
Sulfate 4%
Salt Lake County NOx
point 12%
area 37%
mobile 51%
Area Source NOx
Rail 12%
Res. Nat Gas 24%
Aircraft 16%
Res. Wood 1%
Com/Ind gas/oil 12%
Off road gas
Mobile NOx
HDDV 38%
AGV 62%

Primary PM_{10}



EPA regulations are satisfied with an “attainment demonstration”

- **The goal is to show that in future years the health standard will not be violated**

- **The air quality model demonstrates attainment by simulating the effects of emission controls put on the future year inventory**

- **The starting point for the control strategies are based on the understanding of the relationships shown in the previous slides**